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Quebec Region

Proceedings of the Regional Peer Review Meeting on the Assessment of the Atlantic Mackerel in Subareas 3 and 4

March 8 and 9, 2017
Mont-Joli, Quebec

Chair: Dominique Gascon
Rapporteur: Sonia Dubé

Maurice Lamontagne Institute
Fisheries and Oceans Canada
850 Route de la Mer, P.O. Box 1000
Mont-Joli, Quebec G5H 3Z4

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Canada

Foreword

The purpose of these proceedings is to document the key activities and discussions of the meeting. The proceedings may include research recommendations, uncertainties and the rationale for decisions made during the meeting. Proceedings may also document when data, analyses or interpretations were reviewed and rejected on scientific grounds, including the reason(s) for rejection. Therefore, interpretations and opinions presented in this report may be factually incorrect or misleading, but are included to record, as faithfully as possible, what was considered at the meeting. No statements are to be taken as reflecting the conclusions of the meeting unless they are clearly identified as such. Moreover, further review may result in a change of conclusions where additional information was identified as relevant to the topics being considered, but not available in the timeframe of the meeting. In the rare case when there are formal dissenting views, these are also archived as appendices to the proceedings.

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SUMMARY

This document contains the proceeding from the meeting held within the regional Assessment of the Atlantic Mackerel in Subareas 3 and 4. This review process was held on March 8-9, 2017 at the Maurice Lamontagne Institute in Mont-Joli. This meeting gathered more than forty participants from sciences, management and industry. This proceeding contains the essential parts of the presentations and discussions held and relates the recommendations and conclusions that were presented during the review.

SOMMAIRE

Ce document renferme le compte rendu de l'examen régional par des pairs portant sur l'évaluation du maquereau bleu des sous-régions 3 et 4. Cette revue, qui s'est déroulée les 8 et 9 mars 2017 à l'Institut Maurice-Lamontagne à Mont-Joli, a réuni plus d'une quarantaine de participants des sciences, de la gestion et de l'industrie. Ce compte rendu contient l'essentiel des présentations et des discussions qui ont eu lieu pendant la réunion et fait état des recommandations et conclusions émises au moment de la revue.

INTRODUCTION

The Quebec Region of Fisheries and Oceans Canada (DFO) is responsible for assessing several stocks of fish and invertebrate species harvested in the Estuary and Gulf of St. Lawrence. Most of these stocks are periodically assessed as part of a regional advisory process conducted at the Maurice Lamontagne Institute in Mont-Joli. This document contains the proceedings from the meeting held on March 8 and 9, 2017 on the assessment of the Atlantic mackerel stock in subareas 3 and 4.

The objective of the review was to determine whether there were any changes in the resource's status and whether adjustments were required to the management plans based on the chosen conservation approach, the ultimate goal being to provide scientific advice on managing the Atlantic mackerel stock in subareas 3 and 4 for the 2017 and 2018 fishing seasons.

These proceedings report on the main points discussed in the presentations and deliberations stemming from the activities of the stock assessment regional committee. The regional review is a process open to all participants who are able to provide a critical outlook on the status of the assessed resources. Accordingly, participants from outside DFO are invited to take part in the committee's activities within the defined terms of reference for this review (Appendices 1, 2 and 3). The proceedings also list the recommendations made by meeting participants.

CONTEXT

Meeting chair Dominique Gascon welcomes the participants. He goes over the peer review objectives and agenda. After the participants introduce themselves, stock assessment biologist Thomas Doniol-Valcroze begins the meeting by highlighting the contribution of his collaborators. He briefly presents the assessment schedule and reminds participants that the assessment framework was reviewed recently (January 2017). A summary of the last assessment (winter 2014) is presented, and the terms of reference for this meeting are explained.

Martin Castonguay briefly presents the results of two genetic studies on mackerel population structures, which differentiate the North American from the European population. There seems to be a subtle stock structure in the European population. However, the Canadian and American stocks do not seem to be genetically distinct. Still, the number of samples for North America is limited. Mackerel in the central Atlantic (Iceland and Greenland) are exclusively of European origin.

- One question remains: where do the young-of-the-year caught north of Newfoundland (3K) come from?
- There may also be a subtle distinction within the North American population. Further sampling work and new methods should make it possible to resolve these questions.

Mr. Doniol-Valcroze presents a few components of the species biology and range. Mackerel is a transboundary stock, which means that individuals born in Canada are caught in the American fishery. However, fish born in the United States do not contribute to the Canadian fishery. The biologist focuses on the main issue affecting the quality of the assessment, which is unreported catches: mackerel used as bait in the lobster and crab fisheries, bait for personal use, sales from fisher to fisher, recreational fishing, incomplete logbooks. There are also significant differences in how catches are recorded in different DFO management regions.

Some environmental considerations are explained. The temperature of the cold intermediate water layer and the plankton abundance index are two variables that can explain the trends observed from 1983 to 2012. Work in progress is looking at the relationship between

temperature and spatial distribution, migration times, and spawning times. The volume of water between 6 and 16 °C (0–100 m) is also being assessed to understand how much this habitat (considered optimal for mackerel) varies in space and time. There seems to be significant interannual variability and no clear trend among the regions. Other work will look at egg and larval habitat quality.

- This work includes an inshore component, which is extrapolated by modelling instead of measured in an inshore survey.
- It is noted that there are few juvenile samples, since they are not caught in the survey.

ASSESSMENT OF THE RESOURCE

COMMERCIAL FISHERY

The biologist presents landing statistics by province, unit area, fishing gear, and spatial distribution. Commercial Atlantic mackerel landings reported in NAFO subareas 3 and 4 have declined sharply in recent years. Between 2005 and 2013, they went from 54,621 t to 8,663 t, before reaching 6,680 t in 2014 and 4,143 t in 2015. In 2016, the TAC of 8,000 t was reached. American landings (commercial and recreational) in NAFO subareas 5 and 6 have also dropped sharply in recent years. Between 2005 and 2012, they went from 43,220 t to 6,000 t, where they remained from 2013 to 2015.

- There are significant gaps in the availability of landing data in certain areas. Participants find these gaps regrettable and want them to be filled. They could affect the quality of scientific advice.
- The TAC was reached in 2016, but tonnage by province cannot be determined at this stage.
- For spatial distribution maps, a suggestion is made to adjust the categories (ranges) for a better visual effect.
- Some trap data for 4Ra seem to be missing. For the Newfoundland and Labrador Region, a participant suggests it would be important to record fishing positions to get a better gear-based fishing pattern.

BIOLOGICAL INDICATORS

Mr. Doniol-Valcroze goes over the biological indicators. After increasing in recent years, length at 50% maturity has remained slightly above the minimum allowable catch length of 263 mm. The age structure in this fishery has considerably diminished since the 2000s owing to the disappearance of fish over 7 years old. However, a slight improvement has been observed since 2013, with an increase in the abundance of 5- and 6-year-old mackerel.

- For the Fulton index (body condition factor), a participant suggests a closer analysis over time to better understand the representativeness of this index.
- Participants mention the large numbers of small fish in 2015 and yearlings in 2016, which could mean that 2015 was a good recruitment year.
- In terms of catching small fish, the seine net remains selective, which does not seem to be the case for other fishing gear. Participants say small fish mortality is undoubtedly underestimated.

- A participant asks about the impact of missing data in certain areas on length frequency by division. It seems that 3K heavily influenced the weighting in 2016, even though it is undoubtedly not representative, and 4T should be more significant.
- In terms of the decreased catches in 4R in 2016, industry representatives say that fish presence is very unpredictable. They move around a lot.
- It is noted that a more spread-out age structure means eggs and larvae have a higher chance of finding conditions favourable to survival.

EGG SURVEYS

The abundance index from the egg survey in the southern Gulf reached its lowest level in 2012 (14,568 t) and then rose slowly up to 52,667 t in 2016. This value is still well below the abundance indices of over 750,000 t observed in the 1980s.

- It is noted that the calculation of S, the proportion of eggs laid as of the survey date, is used to check where the year's survey is in relation to peak spawning and to obtain a correction factor to calculate spawning biomass.
- Given that the small sample size before the spawning date can affect the gonadosomatic index and the maturity ogive, a participant suggests assessing the possibility of obtaining more early samples.
- Some participants ask about the restricted coverage of the egg survey. However, previous sampling efforts indicate that current coverage is sufficient. The significant spawning sites are covered.
- In addition, more recent supplementary surveys (2015–2016) covered White and Notre Dame bays in Newfoundland. However, no sign of spawning was observed.
- The egg index is thought to be reliable, since its trajectory is consistent with the observed age structure and landings.
- A participant asks about small fish in some areas that are far from spawning areas (e.g. 3K).
- American colleagues present mackerel egg sampling studies on the American side (1977–2015). They briefly explain the method and results. The values from the past few years are also low.

ANALYSIS OF UNREPORTED CATCHES

The issue of unreported catches was examined by summarizing the available data on bait needs and recreational fisheries and through an online survey of fishers. Both approaches show that total catches can be between 150% and 200% of reported catches, and that the percentage varies from province to province and over time.

- It is noted that a regular update is planned to better inform the model and decrease the uncertainty associated with unreported catches.
- For bait needs, a new bait logbook is being developed in the Newfoundland and Labrador Region. For now, a value of 0 is used. According to industry, it is insignificant.
- A participant asks about how to take foreign catches into account. The answer is that different scenarios will be presented.

PREVIOUS ASSESSMENTS

The biologist provides a brief overview of the approaches used in previous assessments. From 1986 to 2012, indices were derived mainly from the fishery and an egg survey. From 2012 to 2014, Atlantic mackerel abundance was assessed using a sequential population analysis (SPA). This SPA was calibrated using an abundance index calculated from the egg survey. The natural mortality (M) for all age groups and all years was set at 0.2 in the 2012 assessment. For the 2014 assessment, the M values were calculated using the Gislason et al. (2010) relationship. However, high exploitation rates seemed unrealistic. These assessments used only reported catches and were therefore suspected of underestimating the actual size of the stock. In addition, the ICA software used for SPA is now outdated.

NEW ASSESSMENT FRAMEWORK: DESCRIPTION AND RESULTS

To address the uncertainty associated with missing catches, a relatively recent approach involves using so-called "censored" models in which reported catches are explicitly considered biased. The exact value of additional catches is unknown, but the available information is used, for example, to document an upper limit (ceiling). In the new model, the M values were calculated by applying the Gislason et al. (2010) relationship to the recent period (after 1999). The Beverton–Holt stock–recruitment relationship was also used, including an environmental effect. Three versions of the model were assessed: 1) no censorship, where the actual catch was assumed to be equal to the reported catch; 2) informed censorship, including Canadian unreported catches with a ceiling based on catch estimates for bait, recreational fishing and discards; and 3) informed censorship, including Canadian unreported catches and 50% of American and other foreign catches in the ceiling.

The catch-at-age statistical model, calibrated by the egg abundance index and taking into account the uncertainty associated with Canadian unreported catches (version 2), confirmed that mackerel spawning biomass decreased as a result of high exploitation and reached its historical minimum in 2012 (20,000 t). According to the model, the biomass was 40,000 t in 2016.

- It is observed that a higher upper limit gives the model more flexibility to better adjust to the data. Choosing the right upper limit is therefore important, hence the need to provide the model with the most realistic information possible.
- The censored version informed by Canadian unreported catches (version 2) appears more realistic than the uncensored version (version 1). Version 3, which also includes 50% of American catches, does not change the current status or trend but affects the historical part (before 1990) and would benefit from more work to better document it. The decision is made to keep version 2.
- The model seems to adjust well to observation data, although the egg index is higher than the model predicts in years before 1995. Participants wonder about the possibility of external egg inputs or a change in catchability in the survey (q).
- Underestimation of the biomass before 1995 could be due to process and observation errors.
- A participant asks about the spike in recruitment observed in 1969, which must be an artifact of the model.
- It is noted that the science advisory report resulting from this new model must be interpreted as including Canadian reported and unreported catches, meaning total catches.

REFERENCE POINTS, STOCK STATUS AND PROJECTIONS

The limit reference point (LRP) for this stock is based on an approximation of 40% B_{msy} based on $F_{40\%}$ as obtained through a yield-per-recruit analysis. Based on the censored model, in 2016 the stock is at 40% of the LRP of 103,000 t. Projections are used to estimate the risk associated with different catch scenarios.

- Participants note that this stock is deep in the critical zone. In terms of the various catch scenarios, participants find that total catches (reported + unreported) should be low enough to promote recovery.
- The first priority must be stock rebuilding. Then projections can be used to determine the catch levels that would be detrimental to this recovery.

CONCLUSION

INTERIM YEARS

The next scientific review is scheduled for winter 2019. In the meantime, the assembly agrees on a brief update based on the 2017 egg index and landings.

MANAGEMENT REQUEST

Participants decide they are not prepared to support a request from part of the industry to get rid of the minimum legal size. This issue was raised by a fisheries officer because of high small fish catch rates, but this is likely a short-term problem related to the arrival of the 2015 cohort. It is true that the minimum size leads to potentially high mortality from discards, but this minimum size is used to ensure that at least 50% of fish have the chance to reproduce before being caught. A TAC with no legal minimum would have to be lower, would result in a higher number of fish being caught, and would risk lowering the average size of fish caught.

HIGHLIGHTS AND RECOMMENDATIONS

The highlights are presented and the participants comment on them. Comments having to do with stylistic rewording are not reported.

- In the highlight on age structure, the disappearance of fish older than 7 years is noted.
- For the abundance index from the egg survey, it is important to note the high levels in the 1980s.
- In the highlight on unreported catches, participants suggest referring to total catches compared with reported catches, without giving the province-by-province breakdown, which will be in the text of the science advisory report.
- In the highlight on spawning biomass, participants agree that it has declined as a result of high exploitation rates. It is also important to mention the historical minimum of 20,000 t reached in 2012.
- In the highlight on the limit reference point, it is important to note that in 2016 the stock is at 40% of the LRP of 103,000 t.
- In the highlights, participants strongly suggest mentioning the uncertainty associated with unreported catches.

- According to participants, it is important to fill the gaps in commercial fishery sampling in certain sectors, to accelerate compilation of landing statistics, and to improve collection of data on unreported catches. These issues are priorities.
- Participants agree that the priority is stock rebuilding, given that the stock is currently in the critical zone.

Finally, some **recommendations** are made:

Given that the stock is in the critical zone, total catches (reported + unreported) should be low enough to promote recovery.

It is especially important to fill the gaps in commercial fishery sampling in certain sectors, to accelerate compilation of landing statistics, and to improve collection of data on unreported catches.

REFERENCES

Gislason, H., N. Daan, J.C. Rice, and J.G. Pope. 2010. Size, growth, temperature and the natural mortality of marine fish. Fish and Fisheries. 11: 149–158.

APPENDIX 1- LIST OF PARTICIPANTS

Name	Affiliation
Bernier, Denis	DFO Science
Bourdages, Hugo	DFO Science
Carter, Lauren (tel)*	NOAA
Castonguay, Martin	DFO Science
Cawthray, Jenness	DFO Fisheries management - Ottawa
Chevrier, André	DFO Science
Coussau, Lola	ISMER – UQAR
Curti, Kiersten (tel)	NOAA
Cyr, Charley	DFO Science
Desgagnés, Mathieu**	DFO Science
Doniol-Valcroze, Thomas	DFO Science
Dubé, Sonia	DFO Science
Duguay, Gilles	RPPSG
Duplisea, Daniel	DFO Science
Dunne, Erin	DFO Fisheries management – Newfoundland and Labrador
Émond, Kim	DFO Science
Ferguson, Louis (tel)*	Government of New-Brunswick
Gascon, Dominique	DFO Science
Gaudet, Mario	DFO Fisheries management - Gulf
Gauthier, Johanne	DFO Science
Gilbert, Michel	DFO Science
Girard, Linda	DFO Science
Huard, Christian	RPPSG
Huard, David-Henri	RPPSG
Hurtubise, Sylvain	DFO Science
Khamassi, Safouane	ISMER – UQAR
Lambert, Yvan*	DFO Science
Légaré, Benoît	DFO Science
Lelièvre, Lauréat	Industry
Mallet, Pierre	DFO Fisheries management - Gulf
Marentette, Julie	DFO Science - Ottawa
Mbaye, Baye Cheikh**	DFO Science
McQuinn, Ian	DFO Science
Morneau, Renée	DFO Science
Perrin, Geneviève	DFO Science
Plourde, Stéphane	DFO Science
Randell, Randy	FFAW
Richardson, David (tel)*	NOAA
Rivierre, Antoine	DFO Fisheries management - Quebec
Secor, Dave**	University of Maryland
Sheppard, Allan	FFAW
Spingle, Jason	FFAW
Turbide, Carole	DFO Science
Van Beveren, Elisabeth	DFO Science
Waters, Christa	DFO Fisheries management – Maritimes

* present on March 8 only
** present on March 9 only

APPENDIX 2- TERMS OF REFERENCE

Assessment of Atlantic mackerel in subareas 3 and 4

Regional Peer Review – Quebec Region

March 8-9, 2017
Mont-Joli, Quebec

Chairperson: Dominique Gascon

Context

In the Maritime Provinces, in Newfoundland and in Quebec (NAFO subareas 3 and 4), over 15,000 commercial fishers participate in the Atlantic mackerel fishery. This fishery takes place mainly inshore using gillnets, jiggers, handlines, seines and traps. The type of gear used varies by region and time of year. During the 1980s and 1990s, landings by Canadian fishermen were rather stable and averaged around 22,000 t per year. However, there has been a significant increase since the early 2000s, reaching a record high of 54,621 t in 2005 due to the marked increase in fishing effort by small and large seiners on the east and west coasts of Newfoundland (Divisions 3KL and 4R) and the presence in the population of a very important year-class (1999). The average landings of the 2006-2010 period were 43,464 t. They were followed by a severe drop reaching 11,288 t in 2011, 6,468 t in 2012 and 7,431 t in 2013. Canadian landings of Atlantic mackerel are underestimated because some logbooks from the bait fishery are not filled and there are direct sales at sea from that fishery. In addition, neither catches in the recreational fishery, which occurs during summer months all along the Atlantic coast, nor the discards of small mackerel are recorded. The abundance of the spawning stock of Atlantic mackerel is calculated using data collected from an egg survey which occurs annually in the southern Gulf of St. Lawrence.

The mackerel fishery industry recently reported that it catches a lot of fish under legal size. According to the regulations, a fisherman on a fishing trip can't possess more than 10% of mackerel under the legal size of 26.3 cm. However, landing rates of up to 90% of fish below legal size are reported in recent years. There is little information available on the survival rate following release.

The last assessment of mackerel in subareas 3 and 4 was conducted in winter 2014. The Fisheries and Aquaculture Management Branch has requested a scientific advice on Atlantic mackerel in Canadian waters for the 2017 and 2018 fishing seasons. The objective of the review is to determine whether changes that have occurred in the stock status necessitate adjustments to management plans based on the conservation approach used.

Objectives

Provide a scientific advice on the management of the Atlantic mackerel in NAFO Subareas 3 and 4 (Canada's east coast) for the 2017 and 2018 fishing seasons. This advice will include:

- An assessment of the status of Atlantic mackerel, based on:
  - a review of the population structure of Atlantic mackerel in the North Atlantic;
  - an analysis of the commercial fishery statistics following the 2014, 2015 and 2016 seasons (overall distribution of landings, breakdown by province, NAFO Division, fishing gear, etc...);
  - an analysis of the biological data collected in the main port of landings by port samplers or at sea by observers (size structure and calculation of biological indicators);

- an analysis of the egg survey index for 2014, 2015 and 2016;
- a discussion on the quality of the fishery statistics and a review of the main sources of uncertainty;
- ecosystem and environmental considerations;
- A presentation of the new mackerel abundance index developed by US biologists from egg data in US waters;
- A presentation of the results of a statistical catch-at-age model that includes missing catch estimates (following a framework review in January 2017) based on the Canadian catch at the age and the egg survey index. These results will include fishing mortality, abundance and spawning biomass, updating reference points, stock trajectory and predictions of the 2017 and 2018 catches under different fishing mortality scenarios;
- Interim evaluation for illustrative purposes of mackerel in Subareas 3 to 6 which will include US commercial catches and potentially an American egg index.

- Specific elements related to the update of the relevant data to the management of Atlantic mackerel such as:
  - The determination of the process to provide advice during the interim years, including a description of conditions that may warrant a full stock assessment earlier than originally planned;
  - Identification and prioritization of research projects to be considered for the future;
  - Perspectives and/or recommendations for 2017 and 2018 based on available data;
  - Provide advice on a request from Fisheries Management to abandon the minimum size requirement.

Publications prévues

- Science Advisory Report
- 1 Proceedings
- Research Documents

Participation

- Fisheries and Oceans Canada (DFO) (Science and Fisheries Management sectors)
- NOAA Representatives / National Marine Fisheries Service, USA
- Industry representatives
- Provincial representatives
- Academics
- Aboriginal communities/organizations
- Environmental NGOs

APPENDIX 3- AGENDA

Assessment of Atlantic mackerel in subareas 3-4

Regional Assessment Process –Québec Region

March 8-9, 2017
Mont-Joli (Québec)

Chairperson: Dominique Gascon

Day 1 - Wednesday, March 8, 2017

Time	Topic	Presenter
9:00	Welcome, objectives, terms of reference, and agenda	Dominique Gascon
9:15	Introduction: description of stock structure	M. Castonguay
9:45	Introduction: main issues and environmental relationships	T. Doniol-Valcroze
10:15	*Break*	
10:30	Commercial data update 2013-2016	T. Doniol-Valcroze
11:15	Biological data update 2013-2016	T. Doniol-Valcroze
12:00	*Lunch*	
13:00	Egg index update 2013-2016	T. Doniol-Valcroze
13:45	Unis New US egg index	D. Richardson
14:30	*Break*	
14:45	Data on non-declared catches	T. Doniol-Valcroze
15:30	Description of new modeling framework	T. Doniol-Valcroze
16:30	End of Day 1	

Day 2 - Thursday, March 9, 2017

Time	Topic	Presenter
9:00	Welcome and agenda	Dominique Gascon
9:15	Model update including new data	T. Doniol-Valcroze
10:15	*Break*	
10:30	Discussion on model and stock status	All
11:00	*Pause for seminar and lunch*	
13:00	Reference points, projections (F scenarios)	T. Doniol-Valcroze
14:00	Other issues:	T. Doniol-Valcroze

- Subareas 3-6 model
- Interim years
- Minimum size requirement

Time	Topic	Presenter
14:45	*Break*	
15:00	Summary of Science Advice Report	All
16:30	End of Day 2	